OPERATIONAL APPLICATION

Commercial Use and Development Trends of Mobile TV Terminal Chips

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Abstract:
Mobile TV is growing popular worldwide. It puts new hardware requirements on the handset, requiring a tuner, a demodulator and a decoder to receive and process signals that challenge the power consumption and size of handsets. These special terminal chips can solve these problems and stand as a prerequisite for broadcasting TV to mobile phones. The commercial mobile TV handsets have been brought to the market, which use the integrated single-chip, the dual/multi mode chip, or the TV receiver integrated in an SD card. These small chips with low power consumption will help popularize mobile TV services.

Mobile TV is emerging as a killer application in the field of 3G mobile communications due to the popularity and portability of mobile phones. It can be foreseen that mobile TV will become an important support to the development of value-added services in the 3G era[1].

Using mobile TV technologies, the mobile terminal users can have real-time access to news, sports, music TV and interactive programs.

The research company Strategy Analytics predicts that mobile TV would have 50 million subscribers worldwide by 2009, with total revenue of 6.1 billion dollars.

There are no technical problems with mobile TV products. The crucial thing is which network, 3G network or broadcasting and television network, will be selected. If a broadcasting and television network is selected, it is necessary to have a proper standard for mobile TV broadcasting.

Network selection and the related standards for mobile TV broadcasting will determine future trends for functions of mobile terminal chips and product technologies[2-3].

1 Implementation of Mobile TV Services and Terrestrial Digital TV Broadcasting Standards

1.1 Implementation of Mobile TV Services

The mobile TV services are implemented in two ways. One is based on the mobile operator's cellular radio network to enable multi-point transport of streaming media, and the other one uses the digital audio broadcasting spectrum to enable digital multimedia broadcasting. The mobile TV technologies for digital multimedia broadcasting include terrestrial digital and satellite mobile TV broadcasting.

Since the mobile TV made its debut in China in 2004, streaming-media-based mobile TV services have been consecutively deployed around the country. However, the trial operation proves that streaming-media-based mobile TV services are still far from being practical due to the current restrictions in network capacity and expenditure.

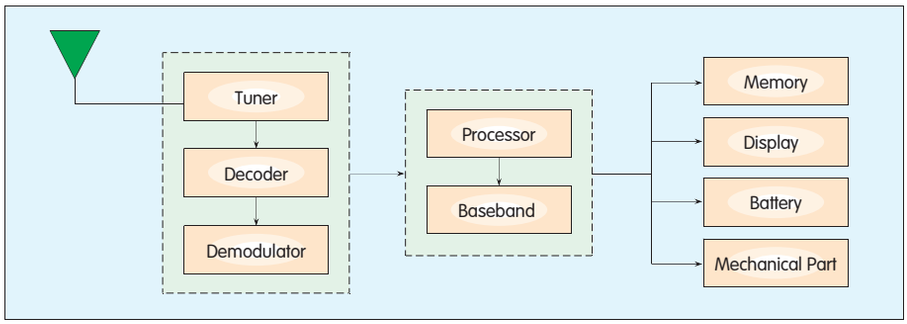
Although, the satellite mobile TV broadcasting system can provide all-around services in a wide range, it is expensive and complex in technology. The satellite mobile TV broadcasting system is only being promoted by South Korea, and will be hardly deployed on a large scale in other regions.

Most insiders have a favorite on mobile TV services implemented by terrestrial digital TV broadcasting in broadcasting and television network. This business mode has been successfully operated abroad, and China has already run the relevant trials.

1.2 Development of Terrestrial Digital TV Broadcasting Standards for Mobile Terminals

Today, the terrestrial digital TV broadcasting standards for mobile terminals include Digital Video Broadcasting-Handheld (DVB-H), Terrestrial-Digital Multimedia Broadcasting (T-DMB), Integrated Services Digital Broadcasting-Terrestrial (ISDB-T), and Media Forward Link Only (Media FLO).

The Korean T-DMB has the highest



▲Figure 1. Operating principle of mobile TV.

commercial usage level, while other standards are still under experiment. South Korean handset vendors, such as Samsung and LG, already experimented on the viewing effect of T–DMB handsets around the world.

The emergence of European DVB–H is attributed to latest convergence of digital TV and mobile communications. Besides, it combines the IP Data Casting (IPDC) technology. The DVB–H standard is widely supported by broadcasting and television operators in Europe, America, and part of Asian regions such as Taiwan, and is showing a tendency to become a dominant standard. The European Telecommunications Standards Institute (ETSI) has adopted DVB–H as the standard for mobile digital TV, and stipulated related technical specifications.

So far, several DVB–H trials are running smoothly, such as the BMCO in Berlin, the Instinct Project in Pan Europe, the TDF Group in France, and the FinPilot in Helsinki. The Crown Castle International, a broadcasting TV network operator in USA, has tried the DVB–H facilities in Pittsburgh, actively exploring the way for commercial introduction of DVB–H based mobile TV services. By June 2005, the open DVB–H tests have been conducted in nine countries and regions worldwide.

China has yet not specified national standards for mobile TV. Many Chinese universities and enterprises have invested a lot into the R&D of mobile TV reception technologies and introduced five proposals. Two of the five proposals are still kept in use today. One of them is the DMB–T solution, which the R&D team led by Tsinghua University used the multi–carrier modulation technology to develop. The other one is the ADTB–T solution, which the R&D team led by Shanghai Jiao Tong University adopted the single–carrier modulation technology to develop. All these achievements lay a foundation for making China's national standards for mobile TV.

It is also possible to emerge a wide variety of mobile TV standards in the future. The coexistence of multiple standards stands as a prerequisite for prosperity of mobile TV.

2 Operating Principle of Mobile TV and Commercial Use of Mobile Terminal Chips

Figure 1 illustrates the operating principle of mobile TV. The section enclosed in the first (left) dashed line box of Figure 1 is the digital TV receiver tuner module that consists of a tuner, a demodulator and a decoder. However, many vendors integrate the decoder into the baseband processor.

The tuner is responsible for channel selection, frequency conversion, Intermediate Frequency (IF) amplification, and filtering of analog signals. Its important performance indicators are power consumption, dimensions, frequency generation, and frequency response.

The decoder is responsible for decoding PAL and NTSC video signals and outputting digital signals in a necessary format. The mobile phone handles these digital signals via its video and media processing center and displays the picture on the screen.

The receiving path for TV signals is independent of that for mobile communication signals of terminals, but they share the media processor after the digital media signals are output. So the display of the mobile phone can be used to receive TV signals.

The demodulator is responsible for demodulation and related functions at the Media Access Control (MAC) and physical layers. It implements time segmentation, IP data extraction, and error correction.

Many companies such as TI, Philips, Freescale, Samsung, Frontier Silicon, DiBcom and Infineon have started research into mobile TV. Table 1 and Table 2 list the mainstream TV tuner chips and decoder chips available for commercial use[4]. In May 2004, Fudan University, Tsinghua University and Legend Silicon Corporation jointly developed "Zhongshi Number One", a special chip for terrestrial transmission of high–definition digital television. This represents a significant step for the related research in China.

3 Development Trends of Mobile TV Terminal Chips

3.1 Low Power and Single Chip

All mobile phone vendors prefer small–sized digital TV receiver tuners no matter what standards they choose for TV broadcasting. Therefore, low power and a small size are the common objective for all mobile TV chip vendors. Certainly, the development of small–sized mobile TV products will eventually lead to the use of

▼Table 1. Mainstream TV tuner chips for commercial use

Manufacturer	Model	Frequency Band	Remarks
Philips	TDA6508, TDA6509	UHF, VHF	—
	TDA8275	It supports reception of analog and digital TV.	It requires few peripheral chips, and allows to be used with TDA8290 together.
Toshiba	TA1284	Unknown	It is similar to Philips TDA6508.
NEC	μPD64031A	It supports Japanese NTSC system.	—
Infineon	TUA6041,TUA6045	It supports T–DMB, DAB, and ISDB–T.	It has been put into mass production.

▼ Table 2. Mainstream TV decoder chips for commercial use

Manufacturer	Model	Frequency Band	Remarks
Philips	TDA9321H	It handles IF TV signals and obtaining the video luminance and color difference signals.	Power consumption: 920 mW; Voltage: 8 V
	TDA8290	It has a combination chip with TDA8275.	Power consumption: 500 mW
NEC	μPD64011BGM–8ED	It handles output signals of μPD64031A directly.	—

▼ Table 3. Mainstream integrated single–chip TV tuners and demodulators for commercial use

Manufacturer	Model	Standard Supported	Frequency Band	Remarks
Philips	BGT211	DVB–H	1.670–1.675 GHz	It adopts SIP technology.
TI	DTV1000	DVB–H	470 –750 MHz, and 1.670 – 1.675 GHz	Its brand is Hollywood.
	DTV1001	ISDB–T	470 – 770 MHz	

single chips[5].

Considering the development of small–sized and low–power mobile TV products, SANYO and SONY have rolled out a TV tuner as small as a stamp, with a power consumption of about 150 mW.

Texas Instruments and Philips Semiconductor have also developed their low–power silicon tuners, lower–power channel decoders and low–power baseband decoder to optimize mobile TV products.

The integrated single–chip TV tuners and demodulators available for commercial use are listed in Table 3. Moreover, many chip vendors are considering the integration of demodulator into the baseband chip.

3.2 Dual/Multi–mode Chips

Nowadays, many vendors have started to develop TV receiver chips that support two or more standards to gain more market opportunities.

Samsung has launched a new–type DVB–H front–end chip set, aiming at the DVB–H based mobile TV market. This product consists of a Zero–IF CMOS RF tuner and a message channel decoder, and is compatible with the DVB–H and DVB–T standards.

In addition, Qualcomm has also started research into the dual–mode chips supporting the DVB–H standard, besides the Media FLO based chips.

To seize more DVB–H market share, all leading chip vendors such as Philips, TI, and Motorola have promised to supply the receivers/tuners supporting the DVB–H standard by the end of 2006.

However, the available dual–mode receiver chips and modules are made simply by a physical superposition of chips of two standards. As shown in Figure 1, the TV tuner and demodulator must use different chips for different standards. With little relationship with the receiver standard, the decoder is dependent on selection of media formats (such as MPEG4 and H.264). In fact, the available dual–mode receivers employ the TV tuner and demodulator chips with different standards.

3.3 Mobile TV Receiver Module Integrated in SD Card

Another method of implementing mobile TV receiver module is to integrate the digital TV signal receiver module into the Secure Digital (SD) memory card.

The French DiBcom Corporation has rolled out its DVB–H based Large–scale Integrated (LSI) circuit for demodulation, DIB7000–H. DIB7000–H and the tuner integrated circuit, MC44CD02 made by American Freescale are packaged on a card to form a standard SD card that can be inserted into the SD slot of a mobile TV terminal. Intel has developed a mobile TV terminal prototype by using DiBcom's TV receiver module integrated in the SD card.

The method of integrating the receiver module into the SD card helps mobile TV terminals support more standards, with no hardware upgrade, short R&D period and low cost. In addition to mobile TV receiving, the SD slot can be used for multiple purposes such as memory expansion, WiFi receiving and bar code scanning, to reduce the risks of terminal vendors and extend their industry chain. Therefore, this method is a development approach worthy of emulation and will enjoy a promising commercial prospect.

4 Conclusions

Besides the chip Hollywood developed by TI, Philips has launched a complete mobile TV platform based on the Session Initiation Protocol (SIP) and put it into mass production[6]. Such semiconductor vendors as STM and Infineon are actively developing their mobile TV solutions, while Qualcomm puts an emphasis on the solution that supports its own Media FLO standard.

The rollout of a variety of mobile TV solutions helps accelerate the development of mobile TV terminals in the coming days. Many handset vendors at home and abroad have launched diversified mobile TV terminals.

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